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(54) **ARYL COMPOUND SUBSTITUTED WITH GLYCIDYL AND ALLYL GROUPS AS MACROMONOMER FOR HEAT RESISTANT RESIN MATERIALS**

ARYLVERBINDUNG SUBSTITUIERT MIT GLYCIDYL UND ALLYL GRUPPEN ALS MAKROMONOMER FÜR HITZEBESTÄNDIGE HARZE

COMPOSÉ D'ARYLE SUBSTITUÉ AVEC GLYCIDYL ET ALLYLE GROUPES COMME MACROMONOMERE POUR DES RÉSINES RÉSISTANTES À LA CHALEUR

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(56) References cited:
US-A1- 2002 192 477 **US-A1- 2003 078 322**

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EP 3 190 107 B1

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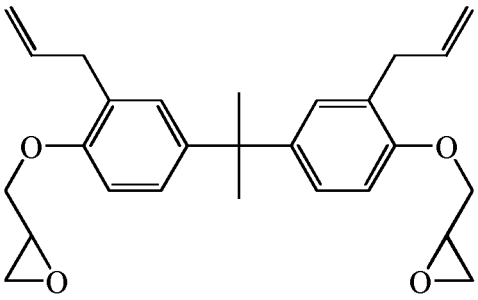
Description

TECHNICAL FIELD

[0001] This invention relates to a novel aryl compound having at least three glycidyl groups and at least three (meth)allyl groups in the molecule and a method for preparing the same.

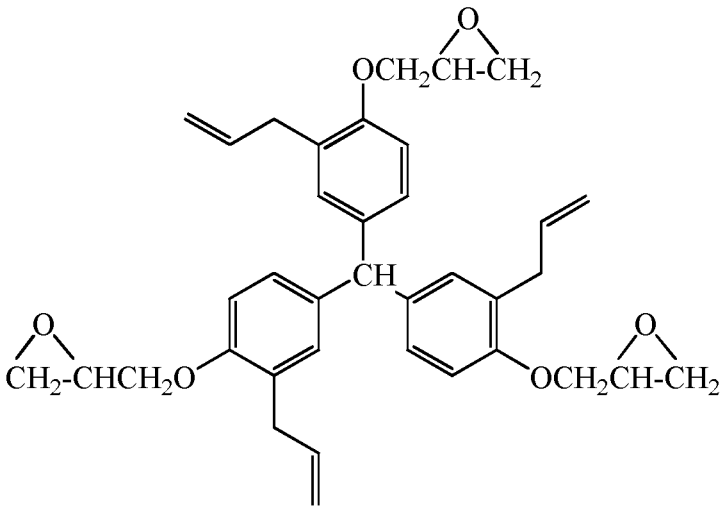
BACKGROUND ART

[0002] Compounds having glycidyl and (meth)allyl groups are known in the art. For example, Patent Document 1 discloses a compound of the following formula:



which is commercially available under the trade name of RE-810NM from Nippon Kayaku Co., Ltd. Since the compound has two epoxy groups in the monomer molecule, a linear polymer is formed by linking epoxy groups, which exhibits poor heat resistance and loses bond strength when exposed to high temperature.

[0003] Patent Document 2 discloses a compound of the following formula.



[0004] In this compound, three phenyl groups having epoxy and allyl are bonded to methyl. The compound has poor heat resistance because the linking hydrocarbon is a low molecular weight one like methyl. This raises the problem that a polymer of the compound with a siloxane is less resistant to CVD film formation and loses bond strength.

[0005] Patent Document 3 discloses a conductive resin composition comprising (A) an epoxy resin, (B) a phenolic resin, (C) a curing accelerator, and (D) a conductive filler.

Citation List

[0006]

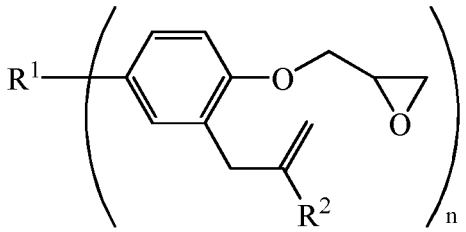
Patent Document 1: JP-A H11-130838
Patent Document 2: JP-A 2002-249584 (USP 6,709,753)

Patent Document 3: US 2003/078322 A1

SUMMARY OF INVENTION

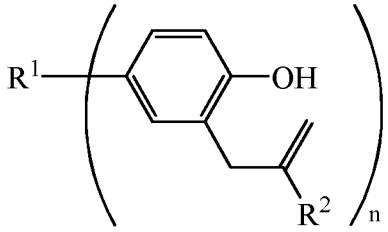
[0007] An object of the invention is to provide a novel aryl compound having glycidyl and (meth)allyl groups which overcomes the aforementioned disadvantages and shortcomings and a method for preparing the compound.

[0008] The inventors have found that an aryl compound having at least three glycidyl groups and at least three (meth)allyl groups in the molecule, represented by the general formula (1) :



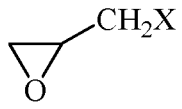
(1)

is prepared by reacting an aryl compound having at least three (meth)allyl-containing phenol groups, represented by the general formula (2):



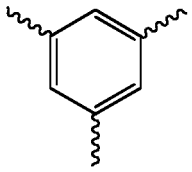
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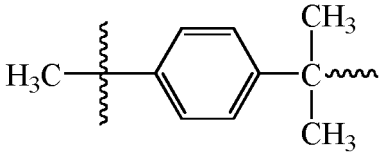
with a 2-halomethyloxirane having the following formula (3):

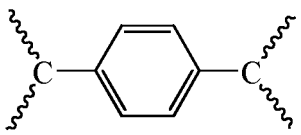


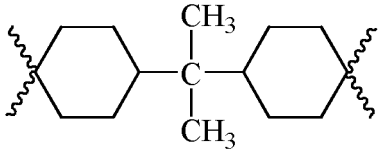
(3)

wherein R^1 is selected from the following groups:



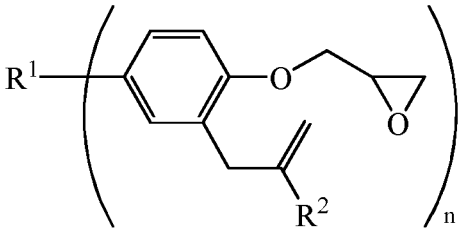






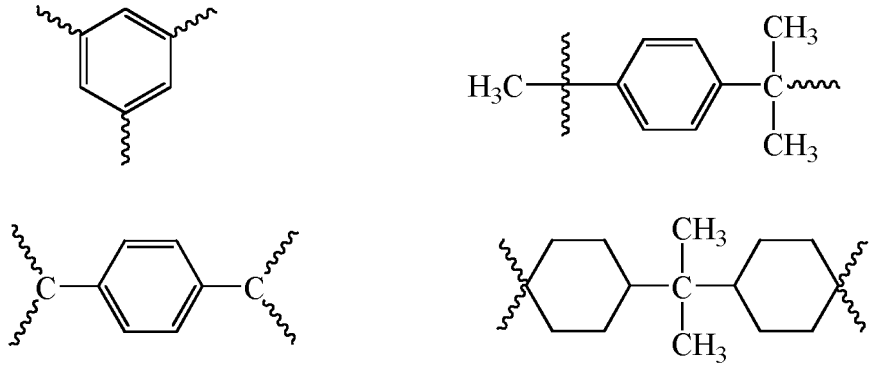
wherein the wavy line designates a valence bond, R^2 is hydrogen or methyl, n is 3 or 4, and X is halogen, and that a polymer formed using the aryl compound of formula (1) has satisfactory strength, heat resistance, weather resistance, and water resistance.

[0009] In one aspect, the invention provides an aryl compound terminated with glycidyl and (meth)allyl groups, having the general formula (1).



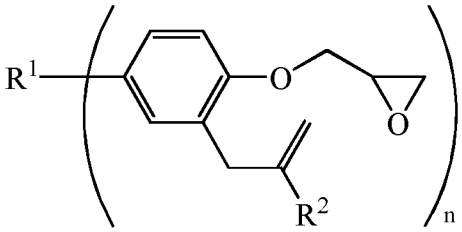
(1)

Herein R^2 is hydrogen or methyl, n is 3 or 4, and R^1 is selected from the following groups:

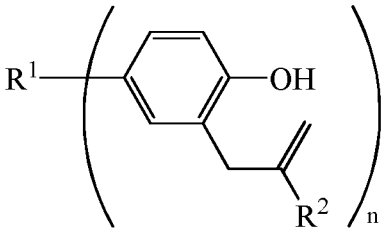


wherein the wavy line designates a valence bond.

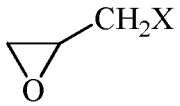
[0010] In another aspect, the invention provides a method for preparing an aryl compound having glycidyl and (meth)allyl groups, represented by formula (1), comprising the step of reacting an aryl compound having (meth)allyl-containing phenol groups, represented by the general formula (2) with a 2-halomethyloxirane having the general formula (3).



(1)

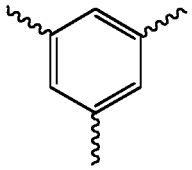
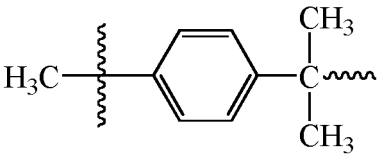
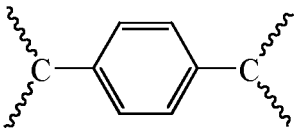
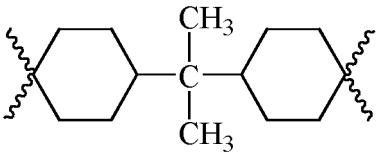


(2)



(3)

Herein R^2 is hydrogen or methyl, n is 3 or 4, X is halogen, and R^1 is selected from the following groups:

wherein the wavy line designates a valence bond.

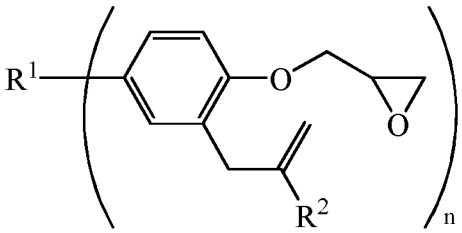
ADVANTAGEOUS EFFECTS OF INVENTION

[0011] The aryl compound having at least three glycidyl groups and at least three (meth)allyl groups in the molecule is polymerizable in two ways using (meth)allyl groups and oxirane rings. Since the aryl compound has at least three functional groups of each type in the molecule, the resulting polymer has a three-dimensional crosslinked structure. A polymer as polymerized using such functional groups is further crosslinkable and curable, and the resulting polymer has satisfactory strength, heat resistance, weather resistance, and water resistance. Therefore, the aryl compound is useful as a macromonomer for heat resistant resin materials.

DESCRIPTION OF PREFERRED EMBODIMENTS

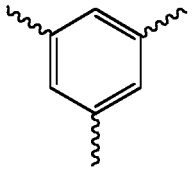
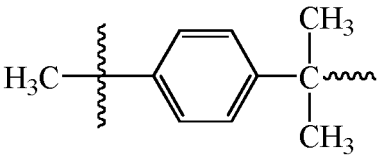
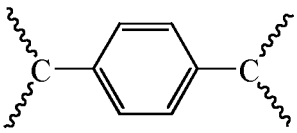
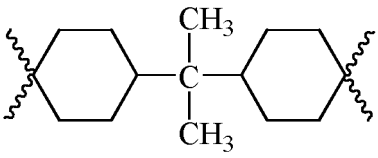
[0012] As used herein, the notation (Cn-Cm) means a group containing from n to m carbon atoms per group.

[0013] One embodiment of the invention is an aryl compound having at least three glycidyl groups and at least three (meth)allyl groups in the molecule, represented by the formula (1):



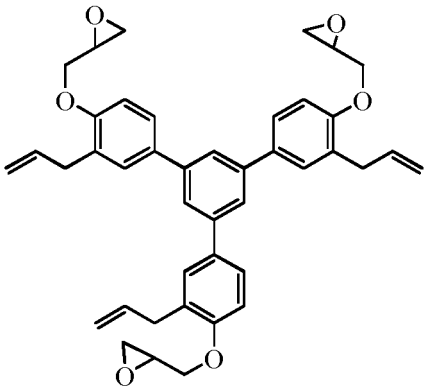
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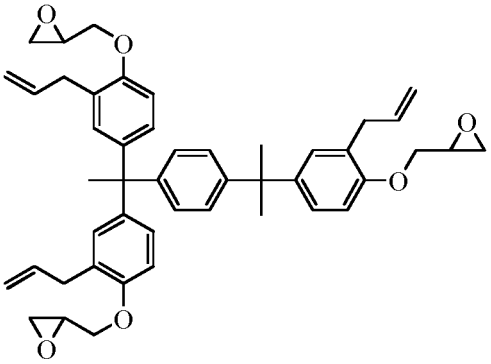
wherein R^2 is hydrogen or methyl, n is 3 or 4, and R^1 is selected from the following groups:

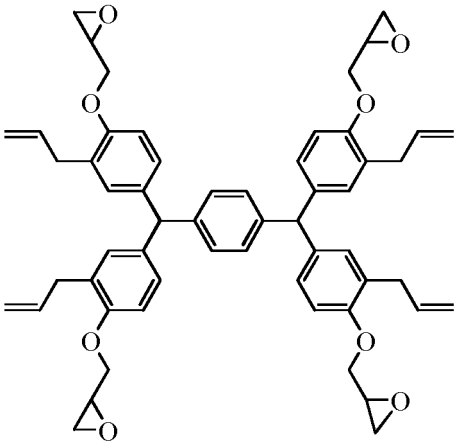





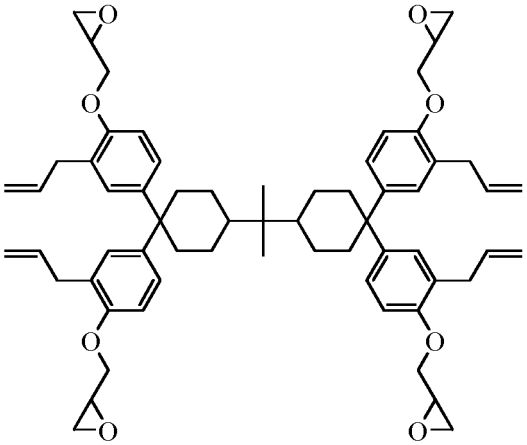
wherein the wavy line designates a valence bond.

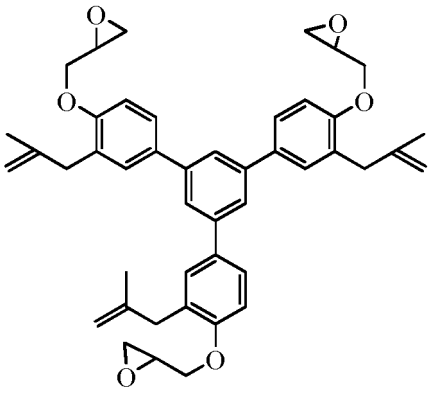
[0014] Typical examples of the compound having formula (1) are shown below.

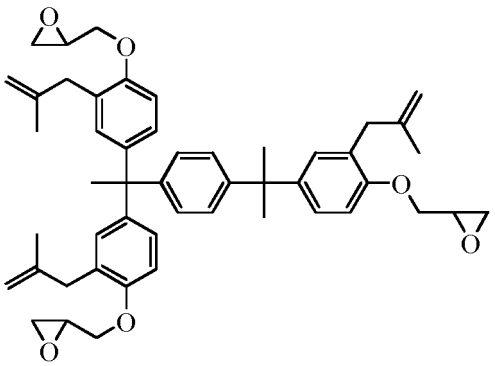


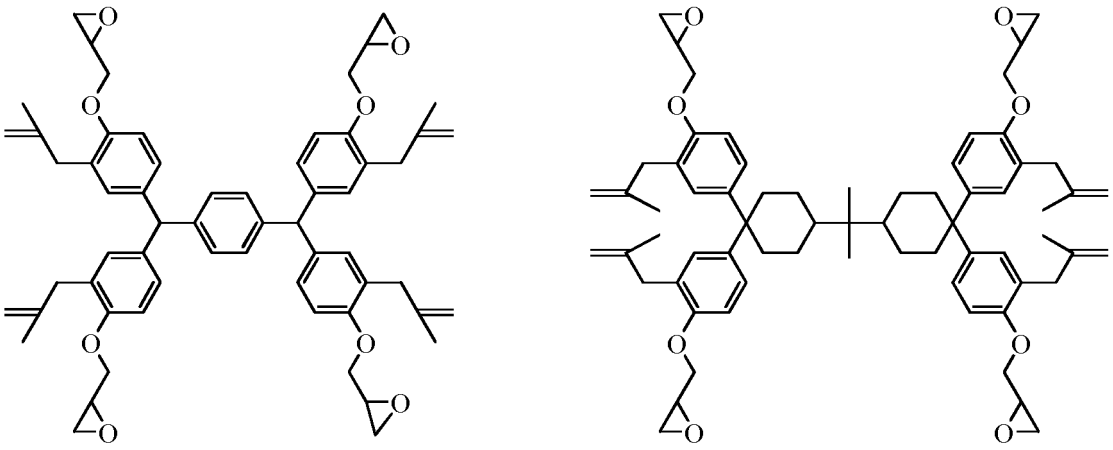




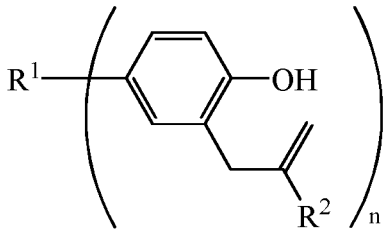






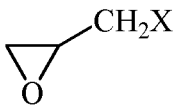


[0015] The aryl compound having formula (1) can be prepared by reacting an aryl compound having (meth)allyl-containing phenol groups, represented by the general formula (2):



(2)

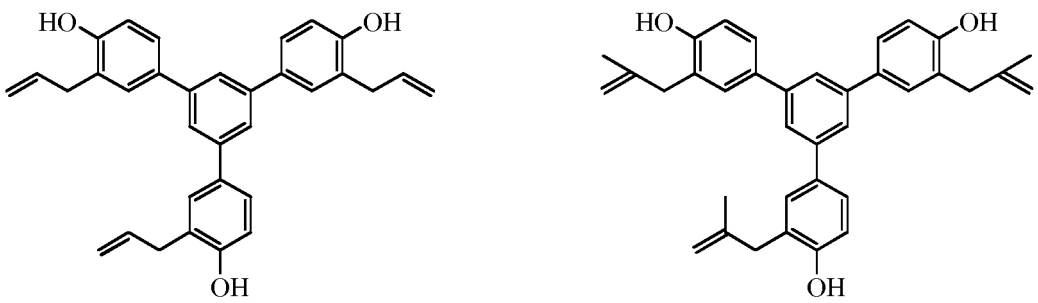
wherein R^1, R^2, and n are as defined above, with a 2-halomethyloxirane having the general formula (3):

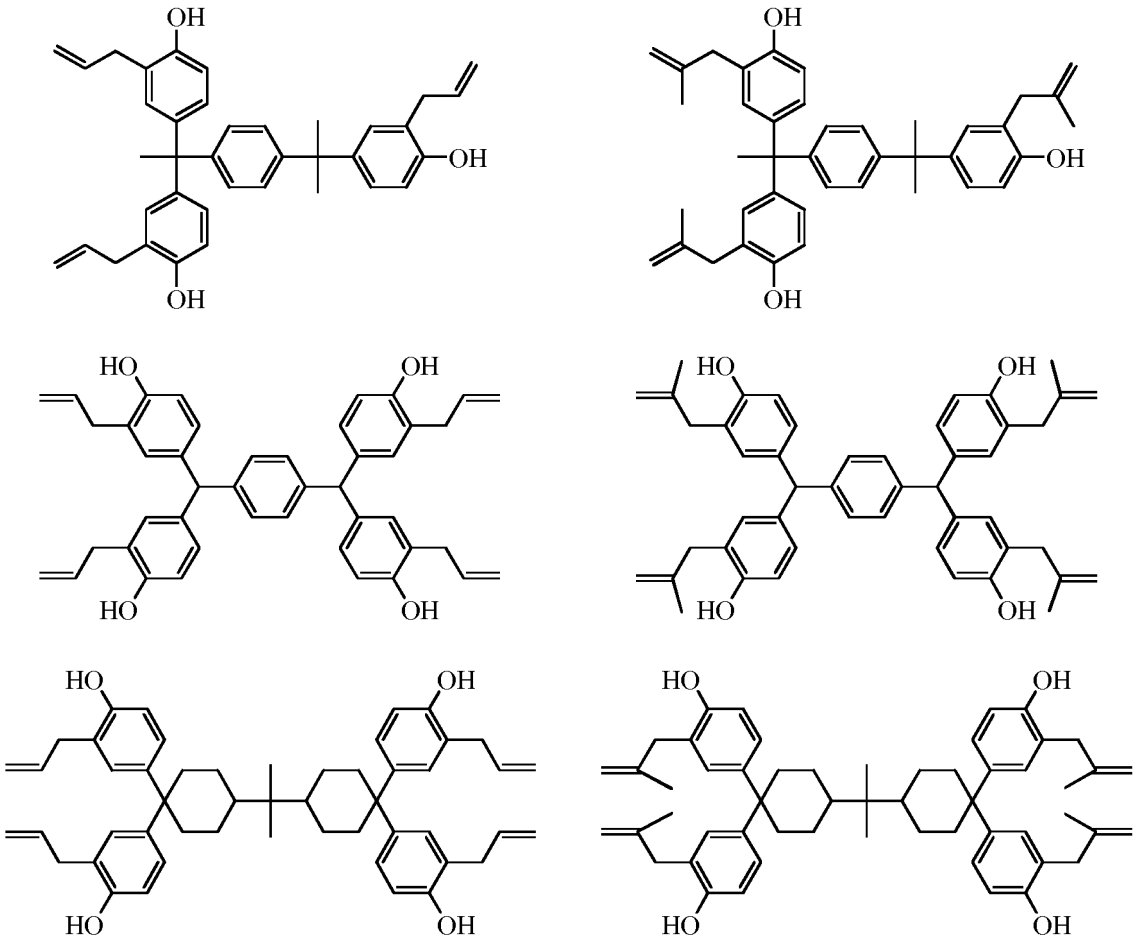


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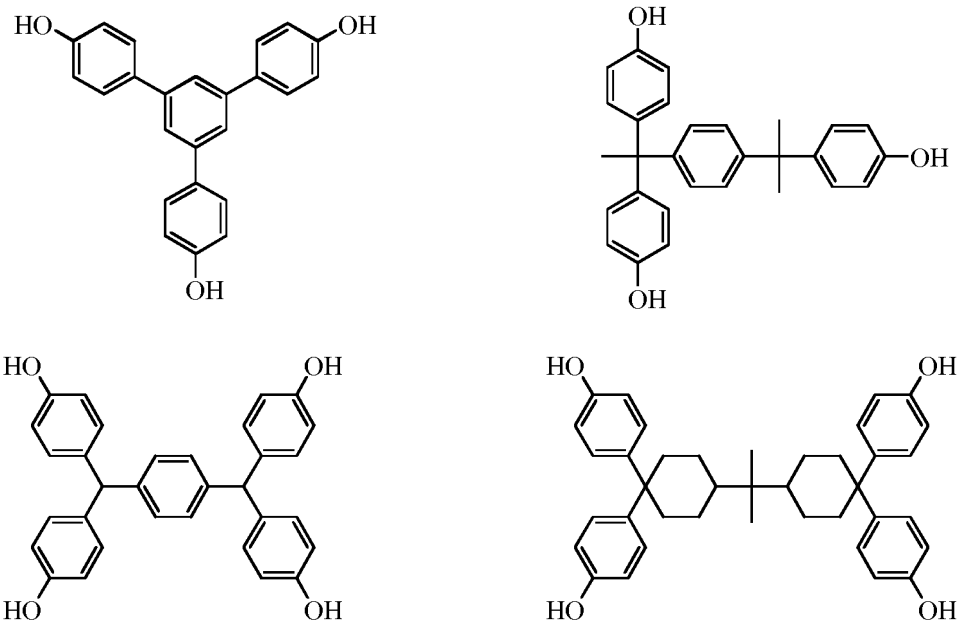
wherein X is a halogen atom, typically chlorine or bromine.

[0016] Typical examples of the aryl compound having (meth)allyl-containing phenol groups, represented by formula (2) are shown below.





[0017] The compound of formula (2) is readily obtained by converting a well-known polyhydric phenol to a (meth)allyl ether and subjecting the ether to the known reaction of Claisen rearrangement. Typical examples of the polyhydric phenol are shown below.



[0018] Typical of the 2-halomethyloxirane of formula (3) are 2-chloromethyloxirane and 2-bromomethyloxirane.

[0019] The compound of formula (2) may be reacted with the 2-halomethyloxirane of formula (3) in any desired ratio.

Typically, the 2-halomethyloxirane of formula (3) is used in an amount of 1 to 10 moles, preferably 2 to 6 moles of halogen groups per mole of phenol groups on the compound of formula (2). Using the 2-halomethyloxirane of formula (3) in a large excess relative to the compound of formula (2), the compound of formula (1) is obtained. If the amount of 2-halomethyloxirane of formula (3) relative to the compound of formula (2) is reduced, an oxirane ring on the 2-halomethyloxirane of formula (3) may react with a phenol group on the compound of formula (2) to form a linked component, which does not adversely affect the invention.

[0020] In the reaction to form the compound of formula (1), a catalyst is optional. Typically, alkali metal hydroxides are used as the catalyst. Suitable alkali metal hydroxides include sodium hydroxide and potassium oxide. The alkali metal hydroxide may be added in solid form or as an aqueous solution or alcohol solution. The alkali metal hydroxide in solid form may be used alone or in admixture and added in divided portions or continuously to the reaction system. On use of an aqueous solution of the alkali metal hydroxide, which means that an excess of water is carried over from the aqueous solution to the reaction system, it is preferred to perform the reaction while removing water from the reaction system. The alkali metal hydroxide is preferably used in an amount of 1.0 to 1.2 equivalents, more preferably 1.0 to 1.1 equivalents per equivalent of phenolic hydroxyl group.

[0021] A solvent may be used in the reaction to form the compound of formula (1). If the 2-halomethyloxirane is added in a large excess, it may also serve as the reaction solvent. Optionally, a separate solvent may be added, and in that case, aprotic solvents are preferred. Examples of the aprotic solvent include dimethyl sulfone, dimethyl sulfoxide, dimethylformamide, 1,3-dimethyl-2-imidazolidinone, 1,4-dioxane, tetrahydrofuran, methyl ethyl ketone, methyl isobutyl ketone, toluene, xylene, benzene, pentane, hexane, heptane, octane, and decane. The aprotic solvent is typically used in an amount of 0 to 500% by weight, preferably 0 to 150% by weight based on the weight of 2-halomethyloxirane. When added, the amount of the solvent is preferably at least 5% by weight.

[0022] The reaction between the compound of formula (2) and 2-halomethyloxirane of formula (3) is performed at any desired temperature, typically in a range of 40°C to 200°C, preferably 50°C to 100°C. The reaction time is about 2 to about 30 hours, preferably 2 to 5 hours.

[0023] The reaction product as such or after washing with water is heated in vacuum to remove the excess 2-halomethyloxirane and the solvent, if used, or the like, obtaining the aryl compound of the invention. The aryl compound is preferably recovered by removing the by-product salt through filtration or water-washing at the end of reaction, and heating in vacuum to distill off the excess 2-halomethyloxirane, solvent and the like.

[0024] Since the aryl compound has at least three glycidyl groups and at least three (meth)allyl groups in the molecule, it may be polymerized by taking advantage of reactive (meth)allyl groups. Particularly, in the case of hydrosilylation reaction of the aryl compound with a SiH-containing siloxane compound, a high-molecular-weight silicone material having a glycidyl-containing three-dimensional crosslinked structure is obtained. In the case of reaction of the aryl compound with OH-containing silicone monomer units, phenol monomer units, or acrylic monomer units, reactive polymers are obtained.

[0025] When reactive epoxy is utilized, the aryl compound may be used as a curable material having a three-dimensional crosslinked structure. After polymerization using these groups, the remaining functional groups are still available for crosslinking and curing.

[0026] Therefore, the aryl compound is useful as a macromonomer for forming polymerizable heat resistant resin materials.

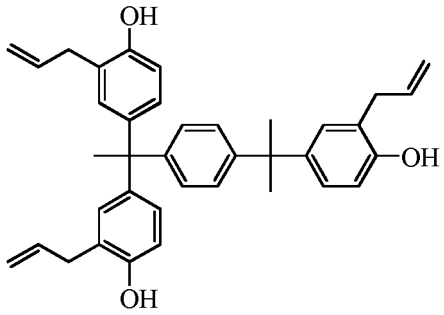
EXAMPLE

[0027] Examples of the invention are given below by way of illustration and not by way of limitation.

[0028] In Reference Examples, the weight average molecular weight (Mw) of a polymer is measured by gel permeation chromatography (GPC) versus monodisperse polystyrene standards using GPC columns TSKgel Super HZM-H (Tosoh Corp.) under analytical conditions: flow rate 0.6 mL/min, tetrahydrofuran as the elute, and column temperature 40°C. All parts are by weight (pbw). The abbreviation NMR stands for nuclear magnetic resonance.

Example 1

[0029] In a 1-L separable flask equipped with a nitrogen gas inlet tube, thermometer, Dimroth condenser, vacuum controller, and aspirator, 109 g (0.2 mol) of the allyl-containing compound of the following formula was dissolved in 100 g of toluene and 167 g (1.8 mol) of 2-chloromethyloxirane.



[0030] To the solution, 26.4 g (0.66 mol) of KOH was gradually added. The contents were heated at 60°C and allowed to react for 3 hours. At the end of reaction, 300 g of pure water was added to the reaction solution to dissolve the precipitated salt whereupon the reaction solution separated into an organic layer and a water layer. The organic layer was 332 g and the water layer was 369 g. From the organic layer, 2-chloromethyloxirane and toluene were distilled off in vacuum, yielding 135 g of a yellowish brown solid compound.

[0031] On epoxy equivalent measurement and ^{1}H-NMR spectroscopy, the resulting compound was identified to be aryl compound A having three allyl groups and three glycidyl groups in the molecule, represented by the following formula. The ^{1}H-NMR data are shown in Table 1.

Compound A

[0032]

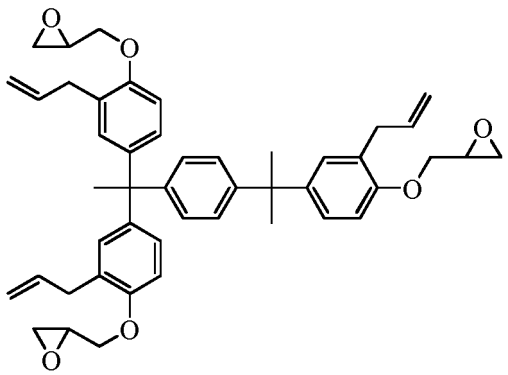
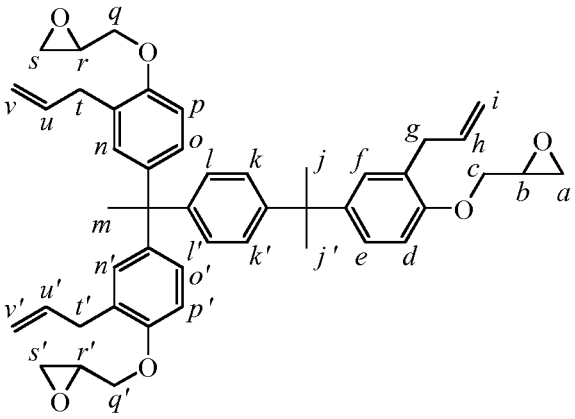


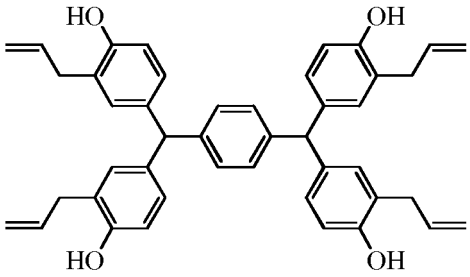
Table 1

Peak	δ, ppm	
j, j'	1.64	6 H
m	2.18	3 H
a, s, s'	2.64 to 2.77	6 H
b, r, r', g, t, t'	3.36 to 3.41	9 H
c, q, q'	3.86 to 4.11	6 H
i, v, v'	5.05 to 5.10	6 H
h, u, u'	5.99 to 6.08	3 H
d, e, f, k, k', l, l', n, n', o, o', p, p'	6.66 to 7.14	13 H



Example 2

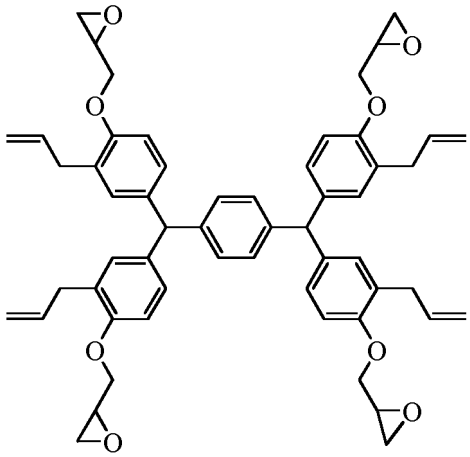
[0033] In a 1-L separable flask equipped with a nitrogen gas inlet tube, thermometer, Dimroth condenser, dropping funnel, vacuum controller, and aspirator, 127 g (0.2 mol) of the allyl-containing compound of the following formula was dissolved in 100 g of toluene and 167 g (1.8 mol) of 2-chloromethyloxirane.



[0034] To the solution, 132 g of 20 wt% KOH methanol solution (0.66 mol of KOH) was slowly added dropwise. The contents were heated at 60°C and allowed to react for 3 hours. At the end of reaction, 300 g of pure water was added to the reaction solution to dissolve the precipitated salt whereupon the reaction solution separated into an organic layer and a water layer. The organic layer was 442 g and the water layer was 382 g. From the organic layer, 2-chloromethyloxirane and the solvent were distilled off in vacuum, yielding 155 g of a brown solid compound. On epoxy equivalent measurement and ^{1}H-NMR spectroscopy, the resulting compound was identified to be aryl compound B having four allyl groups and four glycidyl groups in the molecule, represented by the following formula.

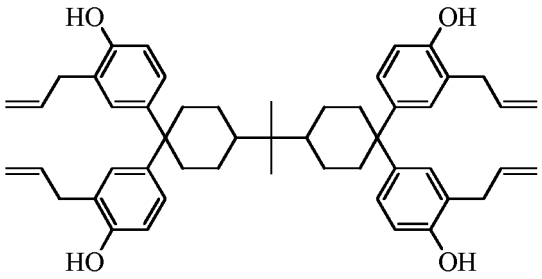
Compound B

[0035]



Example 3

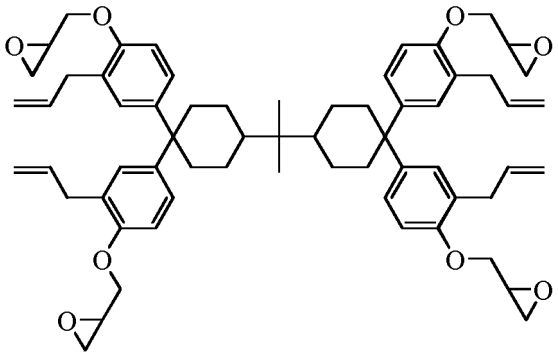
[0036] In a 1-L separable flask equipped with a nitrogen gas inlet tube, thermometer, Dimroth condenser, dropping funnel, vacuum controller, and aspirator, 147 g (0.2 mol) of the allyl-containing compound of the following formula was dissolved in 100 g of toluene and 167 g (1.8 mol) of 2-chloromethyloxirane.



[0037] To the solution, 132 g of 20 wt% KOH methanol solution (0.66 mol of KOH) was slowly added dropwise. The contents were heated at 60°C and allowed to react for 3 hours. At the end of reaction, 300 g of pure water was added to the reaction solution to dissolve the precipitated salt whereupon the reaction solution separated into an organic layer and a water layer. The organic layer was 420 g and the water layer was 384 g. From the organic layer, 2-chloromethyloxirane and the solvent were distilled off in vacuum, yielding 175 g of a brown solid compound. On epoxy equivalent measurement and ^{1}H-NMR spectroscopy, the resulting compound was identified to be aryl compound C having four allyl groups and four glycidyl groups in the molecule, represented by the following formula.

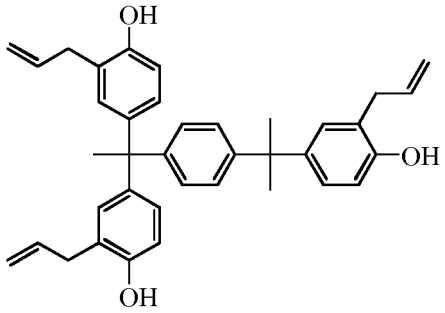
Compound C

[0038]

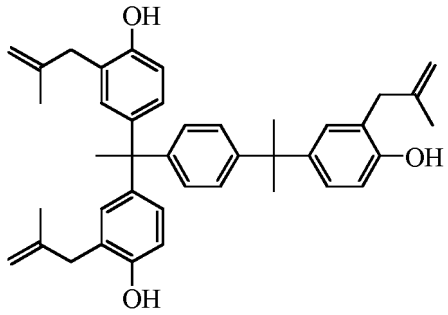


Example 4

[0039] The same reaction and post-treatment procedure of Example 1 was repeated except that the allyl-containing compound of the following formula:



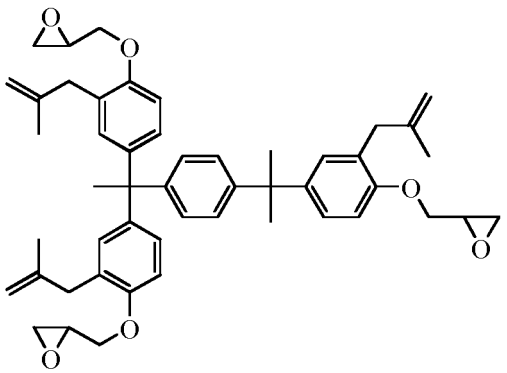
was replaced by 117 g (0.2 mol) of the methallyl-containing compound of the following formula.



[0040] There was obtained 135 g of a brown solid compound. On infrared absorption spectroscopy and ^{1}H-NMR spectroscopy, the resulting compound was identified to be aryl compound D having three methallyl groups and three glycidyl groups in the molecule, represented by the following formula.

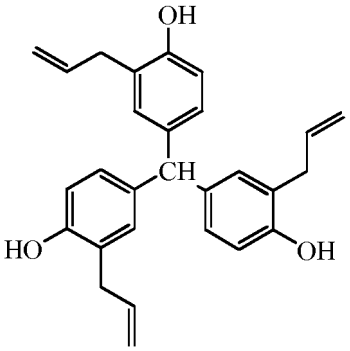
Compound D

[0041]



Comparative Example 1

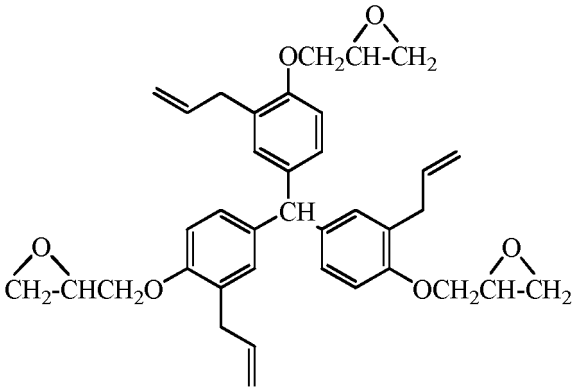
[0042] In a 1-L separable flask equipped with a nitrogen gas inlet tube, thermometer, Dimroth condenser, vacuum controller, and aspirator, 83 g (0.2 mol) of the allyl-containing compound of the following formula was dissolved in 100 g of toluene and 167 g (1.8 mol) of 2-chloromethyloxirane.



[0043] To the solution, 26.4 g (0.66 mol) of KOH was gradually added. The contents were heated at 60°C and allowed to react for 3 hours. At the end of reaction, 300 g of pure water was added to the reaction solution to dissolve the precipitated salt whereupon the reaction solution separated into an organic layer and a water layer. The organic layer was 332 g and the water layer was 369 g. From the organic layer, 2-chloromethyloxirane and toluene were distilled off in vacuum, yielding 98 g of a yellowish brown solid compound. On epoxy equivalent measurement and ^{1}H-NMR spectroscopy, the resulting compound was identified to be aryl compound E having three allyl groups and three glycidyl groups in the molecule, represented by the following formula.

Compound E

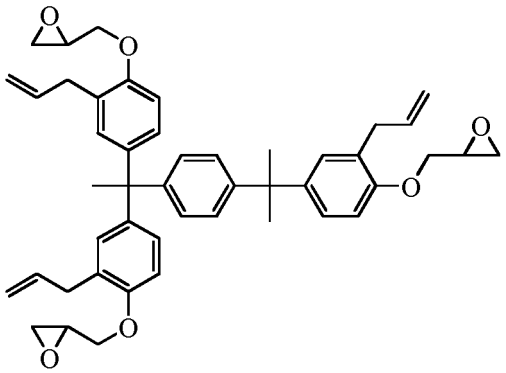
[0044]



[0045] The compounds used in Reference Examples and Comparative Reference Examples are shown below.

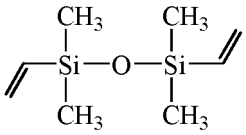
i-1: Compound A obtained in Example 1

[0046]



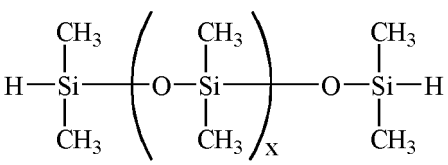
i-2: available from Shin-Etsu Chemical Co., Ltd.

[0047]



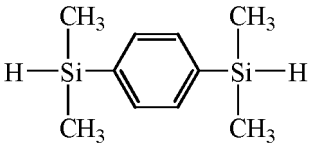
i-3: available from Shin-Etsu Chemical Co., Ltd.

[0048]



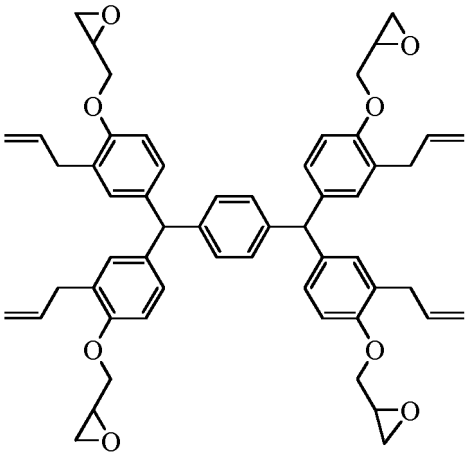
i-4: available from Shin-Etsu Chemical Co., Ltd.

[0049]



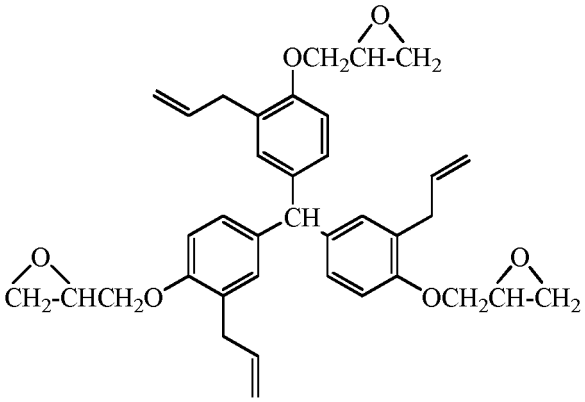
i-5: Compound B obtained in Example 2

[0050]



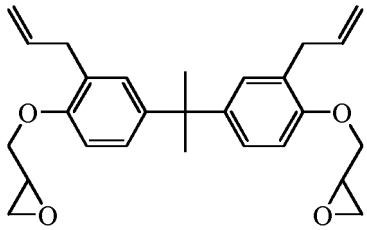
i-6: Compound E obtained in Comparative Example 1

[0051]



RE-810NM: available from Nippon Kayaku Co., Ltd.

[0052]



Reference Example 1

[0053] A 2-L separable flask equipped with a nitrogen gas inlet tube, thermometer, Dimroth condenser, vacuum controller, and aspirator was charged with 11.9 g (0.017 mol) of the compound having formula (i-1) (i.e., Compound A in Example 1), 14 g (0.075 mol) of the compound having formula (i-2) and 63.1 g (0.15 mol) of RE-810NM, then with 1,000 g of toluene, and heated at 70°C. Thereafter, 0.25 g of a toluene solution of chloroplatinic acid (platinum concentration 0.5 wt%) was added and 154.7 g (0.05 mol) of the compound having formula (i-3) wherein x=40 and 38.9 g (0.2 mol) of the compound having formula (i-4) were added dropwise over 1 hour. The total moles of hydrosilyl groups to the total moles of alkenyl groups was 1/1. At the end of dropwise addition, the reaction solution was heated at 100°C and aged for 6 hours. Toluene was distilled off in vacuum from the reaction solution, yielding a resin (I) having Mw of 45,000.

Reference Example 2 (polymer of Compound B)

[0054] A 2-L separable flask equipped with a nitrogen gas inlet tube, thermometer, Dimroth condenser, vacuum controller, and aspirator was charged with 10.7 g (0.013 mol) of the compound having formula (i-5) (i.e., Compound B in Example 2), 14 g (0.075 mol) of the compound having formula (i-2) and 63.1 g (0.15 mol) of RE-810NM, then with 1,000 g of toluene, and heated at 70°C. Thereafter, 0.25 g of a toluene solution of chloroplatinic acid (platinum concentration 0.5 wt%) was added and 154.7 g (0.05 mol) of the compound having formula (i-3) wherein x=40 and 38.9 g (0.2 mol) of the compound having formula (i-4) were added dropwise over 1 hour. The total moles of hydrosilyl groups to the total moles of alkenyl groups was 1/1. At the end of dropwise addition, the reaction solution was heated at 100°C and aged for 5 hours. Toluene was distilled off in vacuum from the reaction solution, yielding a resin (II) having Mw of 42,000.

Comparative Reference Example 1

[0055] A 2-L separable flask equipped with a nitrogen gas inlet tube, thermometer, Dimroth condenser, vacuum controller, and aspirator was charged with 9.9 g (0.017 mol) of the compound having formula (i-6) (i.e., Compound E in Comparative Example 1) and 14 g (0.075 mol) of the compound having formula (i-2), then with 1,000 g of toluene, and heated at 70°C. Thereafter, 0.25 g of a toluene solution of chloroplatinic acid (platinum concentration 0.5 wt%) was added and 154.7 g (0.05 mol) of the compound having formula (i-3) wherein x=40 and 38.9 g (0.2 mol) of the compound having formula (i-4) were added dropwise over 1 hour. The total moles of hydrosilyl groups to the total moles of alkenyl groups was 1/1. At the end of dropwise addition, the reaction solution was heated at 100°C and aged for 6 hours. Toluene was distilled off in vacuum from the reaction solution, yielding a resin (III) having Mw of 35,000.

Reference Examples 3 and 4 and Comparative Reference Example 2

[0056] Curable compositions were prepared by mixing an epoxy-modified silicone resin (resins (I) to (III) obtained in Reference Examples 1 and 2 and Comparative Reference Example 1), a crosslinker (CL) having the following structural formula, and a solvent in accordance with the formulation (type and pbw) shown in Table 2.

Crosslinker (CL)

[0057]

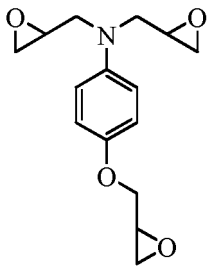


Table 2

	Resin	pbw	Crosslinker	pbw	Solvent	pbw
Reference Example 3	(I)	100	CL	15	cyclopentanone	100
Reference Example 4	(II)	100				
Comparative Reference Example 2	(III)	100				

[0058] The curable compositions obtained in Reference Examples were evaluated for outer appearance, heat resistance, adhesion, and solvent resistance by the following tests. The results are shown in Table 3.

Outer appearance

[0059] The curable composition solution was spin coated onto a silicon substrate, then baked on a hot plate at 130°C for 2 minutes and further at 190°C for 1 hour, forming a cured film of 30 μm thick. The cured film was inspected for outer appearance by visual observation and tack by finger touch. The film was rated good **"○"** when neither cracks nor tack was found and poor **"×"** when cracks and tack were found.

Heat resistance test

[0060] The curable composition solution was spin coated onto a silicon substrate, then baked on a hot plate at 130°C for 2 minutes and further at 190°C for 1 hour, forming a cured film of 30 μm thick. The cured film was placed in a nitrogen atmosphere oven at 250°C for 2 hours and then heated on a hot plate at 270°C for 10 minutes. The outer appearance of the film was observed for anomaly. The film was rated good **"○"** when appearance anomalies such as voids and peels were not found and poor **"×"** when appearance anomalies were found.

Adhesion test

[0061] The curable composition solution was spin coated onto a silicon substrate or copper-deposited silicon substrate, then baked at 130°C for 2 minutes and further at 190°C for 1 hour, forming a cured film. The cured film was placed in a nitrogen atmosphere oven at 250°C for 2 hours and then heated on a hot plate at 270°C for 10 minutes. The film was evaluated for adhesion after temperature exposure by the cross-cut peeling test of JIS K5400 at room temperature. In Table 3, the fractional number represents the number of unpeeled sections per 100 cross-cut sections. Specifically, 100/100 means that all sections are kept intact or unpeeled, and 0/100 means that all sections are peeled off.

Solvent resistance test

[0062] The curable composition solution was spin coated onto a 6-inch (150 mm diameter) silicon wafer, forming a coating of 30 μm thick. The coating was heat dried at 150°C for 2 minutes and then at 200°C for 2 minutes, after which it was immersed in N-methylpyrrolidone (NMP) at 25°C for 10 minutes. The coating was visually inspected whether or not it was dissolved away. The coating was rated good **"○"** when coating dissolution was not observed and poor "×" when coating dissolution was observed.

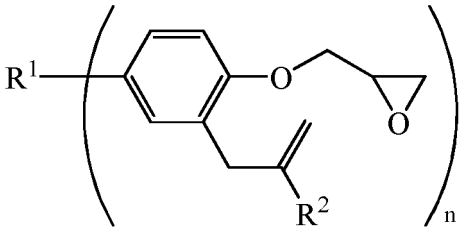
Table 3

		Reference Example 3	Reference Example 4	Comparative Reference Example 2
Outer appearance		○	○	○
Heat resistance		○	○	×
Adhesion (cross-cut peeling test)	Silicon	100/100	100/100	90/100
	Cu-deposited silicon	100/100	100/100	70/100
Solvent resistance		○	○	○

[0063] It has been demonstrated that the novel aryl compound having at least three glycidyl groups and at least three (meth)allyl groups in the molecule is useful as a macro-monomer for heat resistant resin materials.

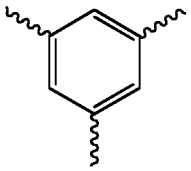
Claims

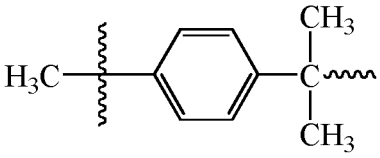
1. An aryl compound terminated with glycidyl and (meth)allyl groups, having the general formula (1):

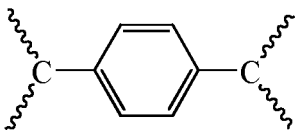


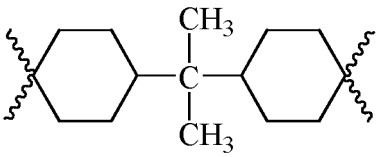
(1)

wherein R^2 is hydrogen or methyl, n is 3 or 4 and R^1 is selected from the following groups:



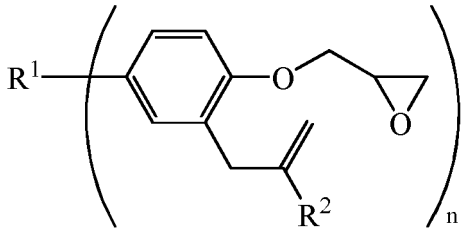






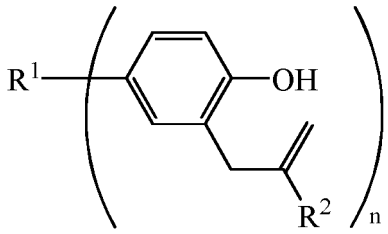
wherein the wavy line designates a valence bond.

2. A method for preparing an aryl compound having glycidyl and (meth)allyl groups, represented by the general formula (1) :



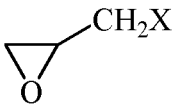
(1)

wherein R^2 is hydrogen or methyl, and n is 3 or 4,
the method comprising the step of reacting an aryl compound having (meth)allyl-containing phenol groups, represented by the general formula (2):



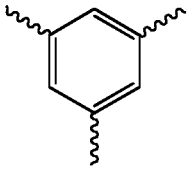
(2)

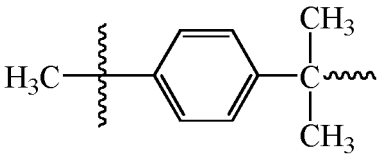
wherein R^2 is hydrogen or methyl, and n is 3 or 4, with a 2-halomethyloxirane having the general formula (3):

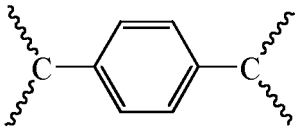


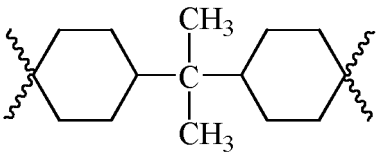
(3)

wherein X is halogen,
wherein R^1 in formulae (1) and (2) is selected from the following groups:





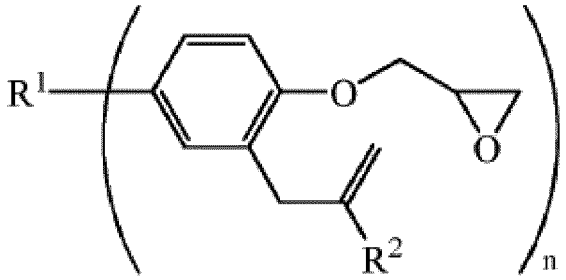




wherein the wavy line designates a valence bond.

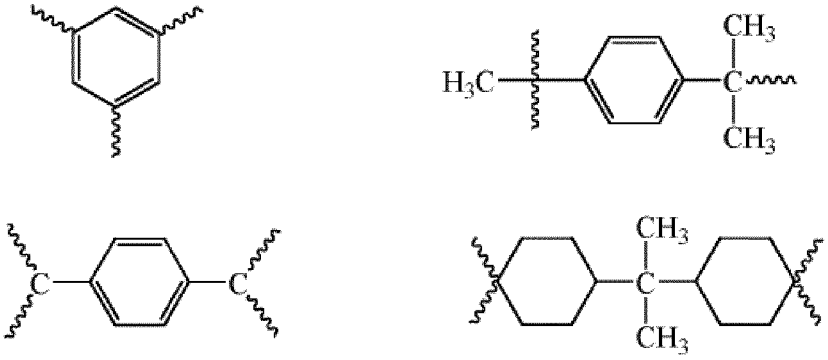
Patentansprüche

1. Arylverbindung, terminiert mit Glycidyl- und (Meth)Allylgruppen, welche die allgemeine Formel (1) aufweist:



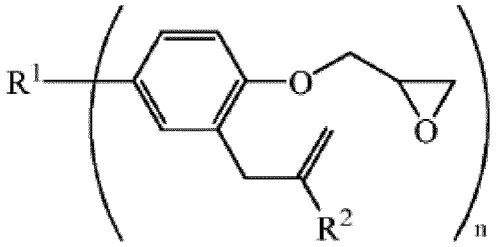
(1)

worin R^2 Wasserstoff oder Methyl ist, n 3 oder 4 ist, und R^1 aus den folgenden Gruppen gewählt ist:



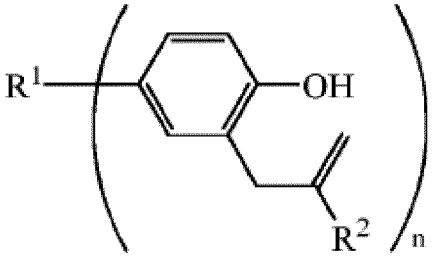
worin die Wellenlinie eine Valenzbindung bedeutet.

2. Verfahren zur Herstellung einer Arylverbindung mit Glycidyl- und (Meth)Allylgruppen, welche die allgemeine Formel (1) aufweist:



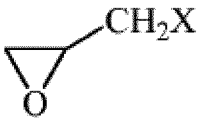
(1)

worin R^2 Wasserstoff oder Methyl ist, und n 3 oder 4 ist,
wobei das Verfahren den Schritt des Umsetzens einer Arylverbindung mit (Meth)Allyl enthaltenen Phenolgruppen, wiedergegen durch die allgemeine Formel (2):



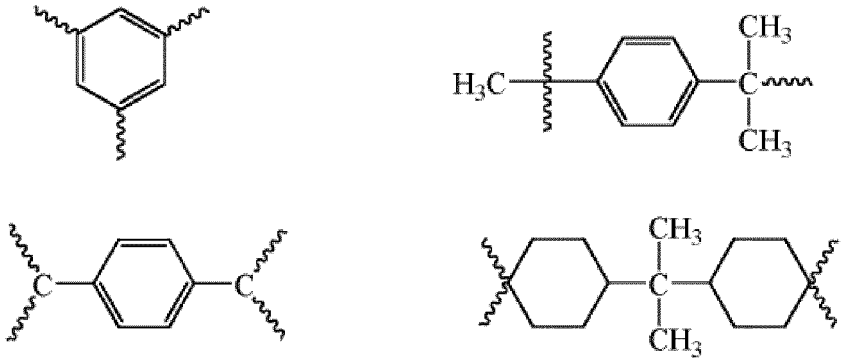
(2)

worin R^2 Wasserstoff oder Methyl ist, und n 3 oder 4 ist, mit einem 2-Halogenmethyloxiran der allgemeinen Formel (3) umfasst:



(3)

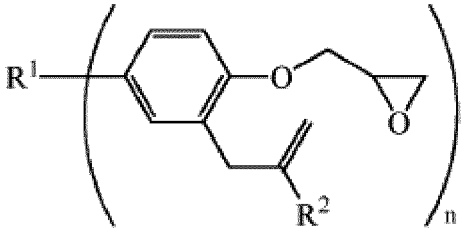
worin X Halogen ist,
worin R^1 in den Formeln (1) und (2) aus den folgenden Gruppen gewählt ist:



worin die Wellenlinie eine Valenzbindung bedeutet.

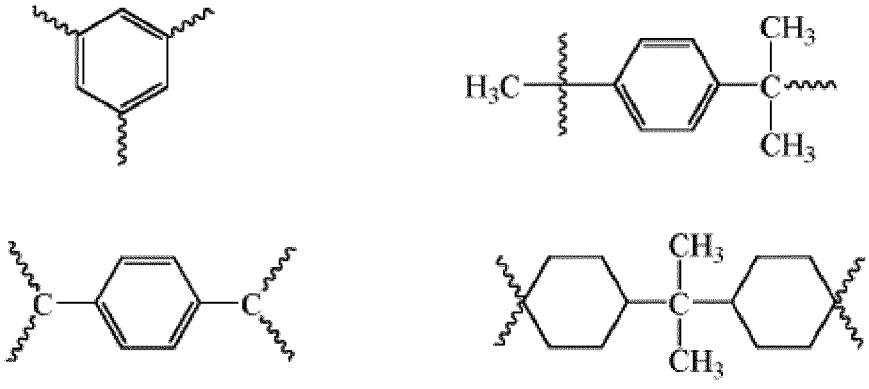
Revendications

1. Un composé aryle terminé par des groupes glycidyle et (méth)allyle, répondant à la formule générale (1):



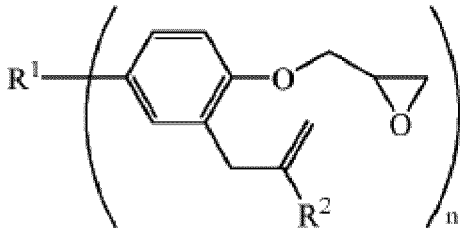
(1)

dans laquelle R^2 est un atome d'hydrogène ou un groupe méthyle et n est égal à 3 ou 4 et R^1 est choisi parmi les groupes suivants:



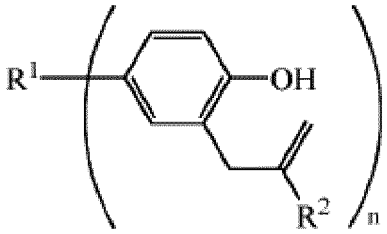
dans lesquelles la ligne ondulée désigne une liaison de valence.

2. Un procédé de préparation d'un composé aryle comportant des groupes glycidyle et (méth)allyle, représenté par la formule générale (1):



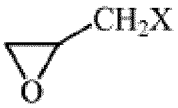
(1)

dans laquelle R^2 est un atome d'hydrogène ou un groupe méthyle et n est égal à 3 ou 4, R^2 est un atome d'hydrogène ou un groupe méthyle et n est égal à 3 ou 4,
le procédé comprenant l'étape consistant à faire réagir un composé aryle comportant des groupes phénols contenant un groupe (méth)allyle, représenté par la formule générale (2):



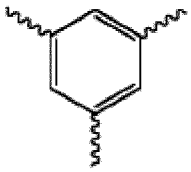
(2)

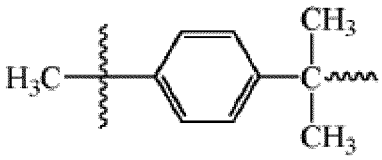
dans laquelle R^2 est un atome d'hydrogène ou un groupe méthyle et n est égal à 3 ou 4, avec un 2-halométhyloxirane répondant à la formule générale (3):

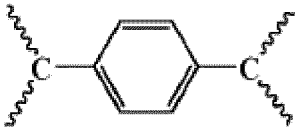


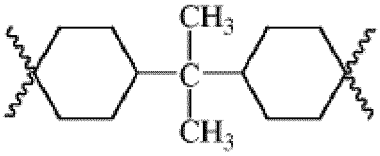
(3)

dans laquelle X est un atome d'halogène,
dans lequel R^1 dans les formules (1) et (2) est choisi parmi les groupes suivants:









dans lesquelles la ligne ondulée désigne une liaison de valence.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H11130838 A **[0006]**
- JP 2002249584 A **[0006]**
- US 6709753 B **[0006]**
- US 2003078322 A1 **[0006]**